Salmon Recovery: Endangered Species Act Tools and Local Roles

A series of workshops for local and regional governments, tribes, watershed councils, and other interested parties
Sponsored by the National Marine Fisheries Service

Viable Salmonid Populations

NMFS defines a ***viable salmonid population*** as an independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year time frame. NMFS uses the concept of a viable salmonid population (VSP) in evaluating hatchery and harvest activities or other activities that directly affect populations, and in identifying de-listing goals for listed ESUs.

A ***population*** is a group of fish of the same species spawning in a particular lake or stream at a particular season which to a substantial degree does not interbreed with fish from any other group spawning in a different place or in the same place at a different season. This definition is widely accepted and applied in the field of fishery management. An ***independent population*** is an aggregation of one or more local breeding units linked by exchange of individuals but sufficiently isolated from other independent populations so that exchanges of individuals among the populations do not appreciably affect the dynamics of the populations or their extinction risk over a 100-year time frame. Such populations are generally smaller than an entire ESU, and they generally inhabit geographic ranges on the scale of whole river basins or major sub-basins that are relatively free of outside migration.

Identifying population units within ESUs and evaluating their individual extinction risk is useful because many of the biological processes that can drive a species to extinction operate at the population level. In addition, by identifying and assessing impacts at the population level, managers can gain a better understanding of the diversity contained within an ESU. Further, given an ESU's scale and complexity, it is typically more practical to assess impacts at the population level than at the ESU level. Finally, assessing impacts at the population level helps ensure that listed salmon and steelhead are treated consistently across a diverse geographic and jurisdictional range.

NMFS uses four biological parameters to evaluate population status and to establish targets that would characterize a viable population. The parameters are (1) abundance, (2) population growth rate, or productivity, (3) population spatial structure, and (4) diversity.

Population abundance refers to population size and is important because smaller populations experience relatively greater genetic, environmental, and demographic risks.

Population growth rate, or productivity, may be thought of as the population's ability to increase or maintain its abundance. Productivity is important because negative trends in productivity over sustained periods may lead to the genetic and demographic risks associated with small population sizes.

Population spatial structure reflects the number, size, and distribution of habitat areas and the condition of the migration corridors that link these habitats. Population structure affects demographic processes and extinction risk in ways that may not be readily apparent from studies of abundance and population growth rate. In addition, spatial structure affects evolutionary processes and may affect a population's ability to respond to environmental changes or events such as floods, earthquakes, landslides, or a serious release of toxic chemicals. Genetic and life-history diversity within a population is important because it helps buffer against such environmental changes.

In applying the VSP concept to harvest, hatchery, and other actions, NMFS relies on two thresholds of population status: (1) a critical population threshold and (2) a viable population threshold. The critical population threshold is a minimal level below which a population's risk of extinction increases exponentially in response to any additional genetic or demographic risks. The viable population threshold is a condition where the population is self-sustaining and not at risk of becoming extinct in the foreseeable future. This threshold reflects the desired condition for individual populations and encompasses their contribution to recovering the ESU as a whole. These thresholds are determined by establishing values for the four biological parameters of viability. A proposed action that would directly affect a population must not push populations toward the critical threshold level nor can it preclude populations from attaining viability.

For more information on the viable salmonid population concept, see "A Citizen's Guide to the 4(d) Rule For Threatened Salmon and Steelhead on the West Coast" (National Marine Fisheries Service, Northwest and Southwest Regions, June 20, 2000, available on the Internet at http://www.nwr.noaa.gov/1salmon/salmesa/final4d.htm) or see "Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units" by P. McElhany, M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt (U.S. Dept. of Commerce, 2000, NOAA Tech. Memo. NMFS-NWFSC-42), also available on the Internet at http://www.nwfsc.noaa.gov/pubs/tm/tm42/tm42.pdf.